with the dissipation of energy. Berthold, who first demonstrated the obedience to physical laws in the fundamental phenomena of the dividing cell or segmenting egg, recognizes, almost in the words of John Hunter, a quality in the living protoplasm, *sui generis,* whereby its maintenance, increase and reproduction are achieved. Driesch, who began as a "mechanist," now, as we have seen, harks back straight to Aristotle, to a twin or triple doctrine of the soul. And Bergson, rising into heights of metaphysics where the biologist, *quâ* biologist, can not climb, tells us (like Duran) that life transcends teleology, that the conceptions of mechanism and finality fail to satisfy, and that only "in the absolute do we live and move and have our being."

We end but a little way from where we began.

With all the growth of knowledge, with all the help of all the sciences impinging on our own, it is yet manifest, I think, that the biologists of to-day are in no self-satisfied and exultant mood. The reasons and the reasoning that contented a past generation call for reinquiry, and out of the old solutions new questions emerge; and the ultimate problems are as inscrutable as of old. That which, above all things, we would explain baffles explanation; and that the living organism is a living organism tends to reassert itself as the biologist's fundamental conception and fact. Nor will even this concept serve us and suffice us when we approach the problems of consciousness and intelligence and the mystery of the reasoning soul; for these things are not for the biologist at all, but constitute the psychologist's scientific domain.

In wonderment, says Aristotle, does philosophy begin,[9] and more than once he rings the changes on the theme. Now, as in the beginning, wonderment and admiration are the portion of the biologist, as of all those who contemplate the heavens and the earth, the sea, and all that in them is.

And if wonderment springs, as again Aristotle tells us, from ignorance of the causes of things, it does not cease when we have traced and discovered the proximate causes, the physical causes, the efficient causes of our phenomena. For beyond and remote from physical causation lies the end, the final cause of the philosopher, the reason why, in the which are hidden the problems of organic harmony and autonomy and the mysteries of apparent purpose, adaptation, fitness and design. Here, in the region of teleology, the plain rationalism that guided us through the physical facts and causes begins to disappoint us, and intuition, which is of close kin to faith, begins to make herself heard.

And so it is that, as in wonderment does all philosophy begin, so in amazement does Plato tell us that all our philosophy comes to an end.[10] Ever and anon, in presence of the *magnalia naturæ,* we feel inclined to say with the poet:

> οὐ γάρ τι νῦν γε κἀχθὲς, ἀλλ' ἀεί ποτε
> ζῇ ταῦτα κοὐδεὶς οἶδεν ἐξ ὅτου φάνη.

"These things are not of to-day nor yesterday, but evermore, and no man knoweth whence they came."

I will not quote the noblest words of all that come into my mind; but only the lesser language of another of the greatest of the Greeks: "The ways of His thoughts are as paths in a wood thick with leaves, and one seeth through them but a little way."

D'Arcy Wentworth Thompson

[9] "Met.," I., 2, 982*b*, 12, etc.

[10] Cf. Coleridge, "Biogr. Lit."

PROSPECTIVE POPULATION OF THE UNITED STATES

Various estimates of the probable or possible future population of the United States

have been made, chiefly on the basis of extrapolation from figures of past growth in comparison with past and present population of other countries, and generally on the assumption that the sources of life and habitability are either unlimited or limited only by land area. One of the latest and most comprehensive estimates is that of Henry Gannett, geographer of the tenth, eleventh and twelfth censuses;[1] it was made without reference to limitation of sources of life, but in the light of the decreasing percentage increment of population shown by records of this and other countries. His figures for prospective increase are essentially arbitrary, decreasing from 21 per cent. during the decade 1900–1910[2] to 5 per cent. for the decade 2090–2100, giving populations of 90,000,000 in 1910, about 250,000,000 in 2000 and 500,000,000 a century later. Thus far no comprehensive extrapolations based on the thirteenth census appear to have been made.

Recent researches tend to indicate that the assumption of unlimited resources, or of resources limited only by land area, is unwarranted; for while the mineral resources of the United States are vast, while the forests are renewable and the farms susceptible of large increase in productivity, while the atmosphere gives little threat of exhaustion (despite the gloomy anticipations of Sir William Crookes and others concerning the stock of nitrogen), and while the available sun-power is thus far used to but a small fraction of its capacity, a practical limit to the productivity and habitability of the country is fixed by limitation in the water supply—and it is worth while to consider prospective population in the light of this limitation.

Standards for the use of water in relation to crop production and the maintenance of human existence arise under irrigation in arid regions, where water is measured more carefully and balanced more exactly against plant and animal life than in humid lands. Here 25 acre-feet of water properly used in agriculture or horticulture will sustain a family of five for a year, with the requisite surplus production for exchange; the best results follow application of the water on five acres of land to an aggregate of five feet in depth as needed during the season. Using water in this way, the rural population is one per acre, or 640 per square mile, stated in terms of land; but it is justly measured only as one for each 5 acre-feet (6,800 tons) of that menstruum which alone renders land productive.

The standards fixed in arid regions are not greatly different from those arising of late in humid lands. Hellriegel in Germany and King in this country have shown that crop plants require for their growth a quantity of water, measured by transpiration, averaging from 300 to 600 (with a mean of about 450) times the weight of the plants after drying; and common field experience indicates that in addition to the moisture passing through the plants the soil requires an even larger quantity to maintain a texture suitable for crop growth —much of which passes away through evaporation and seepage. On this basis "the agricultural duty of water" in this country has been formulated as *the production of one-thousandth part of its weight in average plant crop.*[3] Reckoning human food and drink on this basis, and assuming that meats require (chiefly in the growth of plants used as feed for the animals) ten times the quantity of water represented in vegetal food, it appears that the adult who eats 200 pounds each of bread and beef in a year consumes something like a ton of water in drink and the equivalents of 400 tons in bread and 4,000 tons in meat, or 4,401 tons in all—figures corresponding fairly with the results of intensive agriculture in arid districts. Accordingly, the

[1] Report of the National Conservation Commission (Sixtieth Congress, Second Session, Senate Document 676), 1909, Vol. 2, pp. 7–9.

[2] Perhaps through misprint, Gannett's increment for this decade does not correspond with the population figures; it is put at 21 per cent.—the rate subsequently determined by the Thirteenth Census —though his estimate of 90,000,000 is only 19.2 per cent. above the 75,569,000 (or 18.4 per cent. above the 76,000,000) appearing in his tables.

[3] "Yearbook of the Department of Agriculture," 1910, pp. 169–176; Bureau of Soils Bulletin 71, 1911, pp. 7–14.

"duty of water" considered in relation to human population may be stated roughly as *the maintenance of a human life a year for each 5 acre-feet used effectively in agriculture.*

Now mainland United States (*i. e.*, the chief body of our territory, exclusive of Alaska and the insular possessions) comprises something over 3,000,000 square miles, or somewhat less than 2,000,000,000 acres of land; yet the annual rainfall—the sole original source of fresh water—averages barely 2½ feet (30 inches), or hardly 5,000,000,000 acre-feet. So while the land area, if peopled to the density of Belgium (over 640 per square mile), would carry a population of 2,000,000,000, the water supply suffices for only 1,000,000,000.

Of course all these figures are but approximations; yet they indicate that the method of measuring capacity for population in terms of land area is adapted only to countries in which the water supply is ample, and that in this and most other countries estimates can safely be based only on the quantity of water available for the production of those staples of life used in food and clothing. Water is indeed the primary resource. In plant life it is essential to germination, to tissue-making, to all growth; and far the greater part of the average growing plant consists of water, chiefly in circulation. For men and other animals water is the leading food; the average human ration is some 6 pounds daily, 4½ liquid and 1½ nominally solid, but actually more than one third water—*i. e.*, fully five sixths of the sustenance (and indeed a like proportion of the bodies) of human beings is water. Within the body there is no assimilation or metabolism in the absence of water, nor does germination or any other vital process take place without it or apparently otherwise than as a manifestation of its inherent properties. The measure of water is the measure not merely of productivity but of vitality; and disregarding other climatal factors, the habitability of every country on the globe is determined by the presence or absence, and finally by the quantity, of water distilled from the oceans, circulating through the atmosphere, and descending on the land.

Considered in relation to natural water supply, mainland United States comprises three divisions: (1) the humid section, or eastward states—31 in number—extending from the Minnesota-Louisiana tier to the Atlantic, commonly viewed as the chief part of the country though forming only two fifths of its area; (2) the sub-humid section, or 6 median states from the Dakotas to Texas, containing a fifth of the area of the country; and (3) the semi-arid section, or westward states—11 in number, including Arizona and New Mexico—making up the remaining two fifths of the territory.

Over the humid section the mean annual rainfall ranges from about 25 inches in Minnesota to 55 in Mississippi and over 70 in the southern Appalachians, averaging some 48 inches, or four fifths that required for full productivity. In round figures, the 800,000,000 acres receive annually over 3,000,000,000 acre-feet of rainfall, or nearly two thirds of the entire supply of the country, and now sustain a population of 75,000,000. The prospective population, reckoned on the basis of 5 acre-feet of water supply per capita annually, may reach 600,000,000, or 8 times that of the present; so far as may be foreseen, that population could best be sustained by intensive cultivation to such degree that each ten-acre lot would yield materials for food and clothing for a family of five direct producers, and perhaps an equal number of urban residents living by secondary production or incidental industries.

Over the 400,000,000 acres comprised in the median states the rainfall averages scant 30 inches, or half the water required for full productivity (though as shown by Gannett from 60 per cent. to over 80 per cent. of it falls during the six summer months). While adapted only to extensive agriculture, the capacity of this section for production of staples is far beyond the present yield; if the entire water supply (including the natural sub-irrigation from the Rocky Mountains) were effectively used, it would sustain a family to

each 40-acre lot with another living in town or depending on transportation for livelihood; when the aggregate population would reach 200,000,000, or twenty times that of to-day.

Over the 800,000,000 acres of the westward states the rainfall ranges from less than 2 to over 100 and averages about 12 inches, aggregating some 800,000,000 acre-feet yearly, or a fifth of the productivity standard. The entire water supply would suffice for the intensive cultivation of only 160,000,000 acres; but the present and prospective utilization is highly efficient (the "return water" from irrigation is used over and over again), so that the possible population may be estimated at 200,000,000, or thirty times that of to-day.

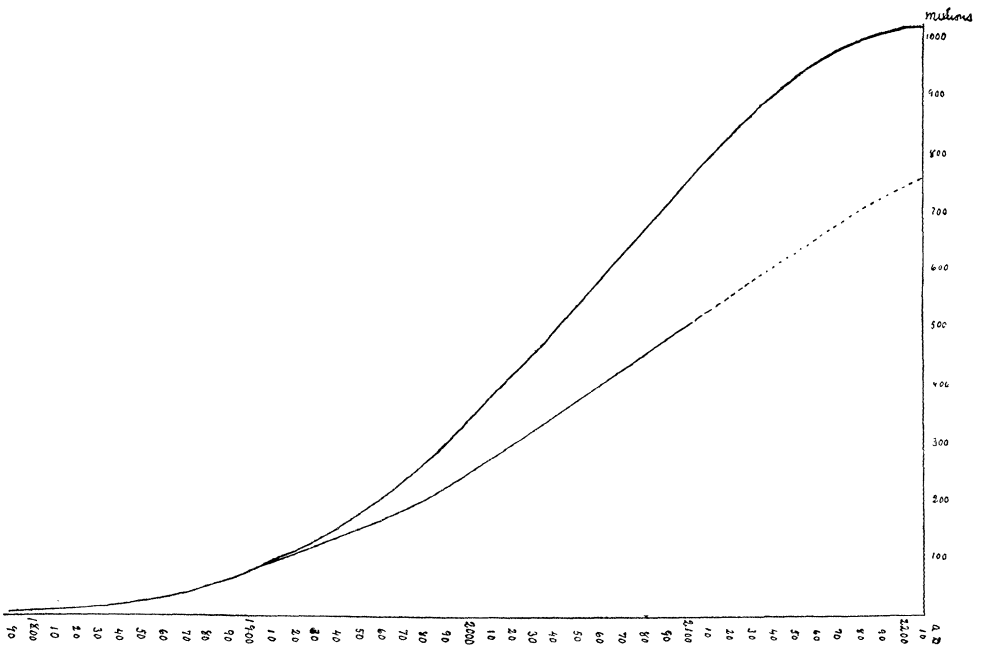
These estimated populations are comparable with present populations in several countries. The 600,000,000 for the eastward states is about one fifth greater than that of China (438,214,000) and Japan (50,751,919) combined; the density is 500 per square mile, almost exactly that of Lombardy (495), little above that of the Netherlands (467), only 1⅓ times that of the United Kingdom (372), little more than three fourths that of Belgium (649), two thirds that of Saxony (778) and half that of (settled) Egypt (931). The 200,000,000 for the median states is considerably less than the population of British India (231,855,583); the density is 333 per square mile, below that of Japan (344) but above that of Alsace-Lorraine (324), Germany (311) and Italy (310), not greatly above that of China (266), and little more than half that of Java (595). The 200,000,000 for the westward states would give a density of 167 per square mile, the same as that of Denmark and Hungary and considerably below that of France (190), Switzerland (234), Bavaria (223), Formosa (226), Austria (246) or Poland (232).[4] The aggregate of 1,000,000,000 for mainland United States is comparable with the present population of Asia or twice that of Europe; the mean density is 333 per square mile, about mid-way between that of the United Kingdom and Germany, little more than half that of Belgium, less than half that of Saxony and only about one third that of Egypt.

The rate of increase in population to the limit fixed by water supply may be extrapolated roughly; and despite the favorable prepossesion due to Gannett's experience (greater perhaps than that of any other census student in the country), his estimate of the decennial increment may be somewhat increased—for several reasons. In the first place his estimate for the 1910 population, although made but a few months in advance of enumeration and in the light of the approximate figures of late prepared in the Census Office, was nearly 2,000,000 too low. Again, the advance during recent years in etiology, sanitation, surgery and other factors of health and viability have virtually given a new lease of life to mankind in this and other countries, while the influence of enlightenment is rapidly spreading, so that (in spite of a declining birth-rate) the population of the world generally appears to be increasing at an unprecedented rate. Furthermore, in this country primary production (*i. e.*, of foodstuffs and textiles) has within a few years past increased with unparalleled rapidity, perhaps more rapidly than manufacturing or transportation in their palmiest days; taking the value of the farm products of 1899 at 100 as a basis, the relative value for 1905 was 133; for 1906, 143.4; for 1907, 158.7; for 1908, 167.3; for 1909, 182.8, and for 1910, 189.2—the absolute value for this last year reaching $8,926,000,000.[5] Meantime the influx of prolific immigrants continues, and a large proportion of them are finding their way into rural districts and primary industries where the conditions are favorable to family life. These various considerations warrant the expectation of a vigorous and sustained growth in the population of this country for many years.

It is true that apparent indications of ap-

[4] The figures are taken (the population-density generally computed) from areas and populations in the "Statesman's Yearbook," 1910, supplemented by records for 1910 compiled by Gannett (*Nat. Geog. Mag.*, Vol. XXII., 1911, p. 785).

[5] "Yearbook of the Department of Agriculture," 1910, p. 10.



proaching paralysis have arisen, *e. g.*, in a cost of living exceeding that of any other age or country, in diminishing exports of foodstuffs, etc.; yet it seems probable that these conditions mark a temporary rather than permanent disturbance of economic balance between primary and secondary industries—a disturbance destined to be progressively adjusted, unless current signs of the times be wholly misleading. The primary industries—the production of materials for food and clothing chiefly from the soil through utilization of the natural water supply—dominated the growth of the country from 1776 to about 1850; but especially during the half-century 1850–1900 the secondary industries of manufacturing and transportation expanded beyond all precedent or parallel, until the annual value of manufactures arose to more than twice that of the primary staples, and the cost of transportation increased to a quarter or a third of the value of primary production. Despite this industrial revolution, a reasonable balance was long maintained through rapid agricultural expansion and the bringing of virgin fields under cultivation, whereby the secondary workers were fed and clothed without appreciable burden on the resources of the country. Of late this method of maintaining the economic balance has failed, since the virgin fields available for settlement and cultivation in the old way are exhausted—and the industries of the United States have grown top-heavy in manufacturing and transportation. The burden of manufacturing is the greater by reason of a tariff adapted neither to the raising of revenue nor to the protection of American workmen so much as the concentration of capital; yet indications are clear that within a year this burden will be materially reduced by revision of the tariff laws. The burden of transportation has arisen chiefly with the growth of railways in property and power until the simple economic law of supply and demand has been replaced by the arbitrary formula "what the traffic will bear," which largely controls production; the annual cost of railway transportation (of which some 70 per cent. is freightage) is now about $2,700,000,000, equivalent to an impost of $5.25 per acre on the 475,000,000 acres of improved land in this country, or a personal tax of $150 per family (fully one third of the average cost of

PAST AND PROSPECTIVE POPULATION OF MAINLAND UNITED STATES

Year A.D.	Present Estimate			Gannett Estimate		
	Population	Increase		Population	Increase	
1790	3,929,214	.....	.....	3,929,000	.....	.....
1800	5,308,483	1,379,269	=35.1%	5,308,000	1,379,000	=35 %
1810	7,239,881	1,931,398	36.4	7,240,000	1,931,000	36
1820	9,638,453	2,398,572	33.1	9,638,000	2,399,000	33
1830	12,866.020	3,227,567	33.5	12,866,000	3,228,000	33
1840	17,069,453	4,203,433	32.7	17,069,000	4,203,000	33
1850	23,191,876	6,122,423	35.9	23,192,000	6,122,000	36
1860	31,443,321	8,251,445	35.6	31,443,000	8,251,000	36
1870	38,558,371	7,115,050	22.6	38,558,000	7,115,000	23
1880	50,155,783	11,597,412	30.1	50,156,000	11,597,000	30
1890	62,947,714	12,791,931	25.5	62,622,000	12,466,000	25
1900	75,994,575	13,046,861	20.7	75,569,000	12,946,000	21
1910	91,972,266	15,977,691	21.0	90,000,000		21(?)
1920	110,000,000	18,000,000	20	104,000,000		16
1930	131,000,000	21,000,000	19	119,000,000		14
1940	155,000,000	24,000,000	18	134,000,000		13
1950	181,000,000	26,000,000	17	150,000,000		12
1960	210,000,000	29,000,000	16	167,000,000		10
1970	241,000,000	31,000,000	15	184,000,000		10
1980	275,000,000	34,000,000	14	202,000,000		10
1990	311,000,000	36,000,000	13	225,000,000		11
2000	348,000,000	37,000,000	12	249,000,000		11
2010	386,000,000	38,000.000	11	274,000,000		10
2020	425,000,000	39,000,000	10	299,000,000		9
2030	463,000,000	38,000,000	9	325,000,000		9
2040	505,000,000	42,000,000	9	350,000,000		8
2050	545,000,000	40,000,000	8	375,000,000		7
2060	589,000,000	44,000,000	8	400,000,000		7
2070	630,000,000	41,000,000	7	425,000,000		6
2080	674,000,000	44,000,000	7	450,000,000		6
2090	714,000,000	40,000,000	6	475,000,000		5
2100	757,000,000	43,000,000	6	500,000,000		5
2110	795,000,000	38,600,000	5	*525,000,000*		*5*
2120	835,000,000	40,000,000	5	*551,000,000*		*5*
2130	868,000,000	33,000,000	4	*573,000,000*		*4*
2140	903,000,000	35,000,000	4	*596,000,000*		*4*
2150	930,000,000	27,000,000	3	*620,000,000*		*4*
2160	958,000,000	28,000,000	3	*645,000,000*		*4*
2170	977,000,000	19,000,000	2	*671,000,000*		*4*
2180	997,000,000	20,000,000	2	*691,000,000*		*3*
2190	1,007,000,000	10,000,000	1	*712,000,000*		*3*
2200	1,017,000,000	10,000,000	1	*733,000,000*		*3*
2210	1,017,000,000	0	0	*755,000,000*		*3*

living); but already the railways are passing under regulation in the public interest by the Interstate Commerce Commission, while with that proper development of waterways destined to come before the next decennial census the aggregate cost of freight movement will be reduced 20 per cent. or 30 per cent. So on the whole any apparent paralysis in growth arising in imperfect economic balance would seem to be more apparent than real, and at the worst of temporary character.

The decennial percentage increment of population decreases normally with growth. During the twelve decades covered by the United States census the increments have varied from 36.4 per cent. (1800–1810) to 20.7 per cent. (1890–1900), averaging 30.4 per cent.; the mean for the earlier six being 34.4 per cent. and for the later six 25.9 per cent. The decreases have not been uniform; during the second decade there was a slight increase, during the sixth a decided increase, during the ninth (following the civil war decade) a still greater increase, and during the twelfth a slight increase (from 20.7 per cent. to 21 per cent.).

In the extrapolation based on (1) past growth, (2) current promise of prospective growth and (3) limitation of growth by water supply, it may be assumed that the percentage increment will diminish steadily at the rate of 1 per cent. during each decade for a century, and then more slowly (1 per cent. during each two decades) for two centuries more, when the population limit fixed by water supply may be reached. Reckoned on this assumption, the prospective population is shown in the accompanying table and diagram (the figures from 1790 to 1810 from Census Bulletin 109), in which Gannett's estimates are introduced for comparison, and extended from A.D. 2100 to A.D. 2210 on the basis of percentage increments decreasing conformably with his figures for the two preceding centuries.

It is true that in the era of commercial interchange on which the world has fairly entered no country exists wholly unto itself, but subsists in part on the resources of other lands and in prospectively increasing degree on those of the waters; theoretically, the population-estimate for any country should take account of the capacity of other countries for yielding and exchanging necessaries of life—*i. e.*, the materials for food and clothing; but practically, the cost of exchange (including transportation) imposes a burden directly on the consumers and less directly on the producers of commodities, and if these are prime necessaries this burden tends quickly to become unbearable—when the people on whom it rests must cease increasing and may even decrease until an economic balance is attained. Yet by reason of areal extent and variety of resources, mainland United States is potentially self-contained in exceptional degree (unexcelled natural wealth in materials for manufacturing and the development of power are combined with a large capacity for

producing prime necessaries), so that prognostications of growth in this country are apparently safer than in any other. The very extent of territory contributes to its self-content and isolation; its magnificent distances involve such cost in transportation (and must continue to do so, despite prospective improvement in facilities) as to limit interchange between producing areas and ports, and thus to restrict foreign commerce; every transcontinental traveler must be impressed by the vast tracts in the westward states unproductive and nearly uninhabitable because of aridity, yet few realize that with half its area and the present water supply equably distributed mainland United States could sustain a population equal to its present capacity and maintain freer foreign commerce by reason of the reduced average distance and cost of domestic traffic. The various factors affecting any forecast of future production and population in this country indicate that the growth will be exceptionally independent and presumably uniform. The highest numerical increment in the accompanying tabulated estimate (for a century and a half hence) is 44,000,000 in a decade, only $2\frac{3}{4}$ times that of the last decade with an estimated population sevenfold greater. The maximum estimated population of about 1,000,000,000 is less than eleven times that of 1910; and any excess in the estimated increments may be balanced by extending the estimated date (about A.D. 2200) a few decades further into the future. By way of comparison it may be noted that since the rainfall on the lands of the globe is some 30,000 cubic miles (or 100,000,000,000 acre-feet), the maximum world population, computed on the same basis, is 20,000,000,000, or about thirteen times the present 1,500,000,000.

Whatever the probability of error in the forecast, it would seem timely to consider the prospective population of this and other countries in the light of the leading lessons of anthropology, (1) that the development of mankind is progressive, (2) that the distinctive attribute of the human realm is mentality and (3) that through cumulatively advancing mentality man (unlike other organisms) adjusts himself to environment in increasing degree by subjugation of lower nature. Accordingly, the capacity for population of any country during any generation depends not merely on the natural resources but on these resources as modified and adapted to human needs by human genius; while the food quest is fundamental, the sources of food (and of clothing as well) for enlightened folk are not the natural fauna and flora but cultivated and virtually artificialized plants and animals; while tools and machines and mechanical power are necessaries of industrial activity, their sources are no longer those found ready-made in nature but are secondary products gained by artificial conversion of natural materials and forces—and no end to this reconstruction of nature is in sight save the limitation to life first in water supply and then in other constituents of atmosphere and earth. Meantime the power and efficiency of humanity are advancing; throughout the world men now meet in amity rather than instinctive enmity as in savagery and barbarism, and while there will yet be bloody battles before warfare is made so sanguinary by mechanical and chemical devices that mankind will revolt against it, the current trend is toward national no less than individual obedience to law and hence toward international peace; famine grows less fatal with advancing solidarity of peoples; pestilence is passing with the advance of science and philanthropy; health and happiness and viability have increased almost uninterruptedly from the prime to the present, and give every promise of continued increase; and most significant of all, the social and governmental institutions of all countries are steadily rising from primitive types in which the lives of the many were at the mercy of a favored few to that plane on which all lives are alike sacred—indeed the modern and prospective governmental form is but the organized expression of the knowledge and opinions and sentiments—*i. e.*, of the essentially human traits—of a constituent citizenry. In the light of past progress, it is the manifest destiny of the temperate and tropical zones to

be subjugated and controlled for human welfare through a continued and cumulative conquest limited only by capacity for yielding necessaries of life. While other limiting factors may arise as mentality extends and intensifies, that most evident to-day in this and several other countries is the water supply; yet even this barrier may not prove insuperable by advancing invention so long as the constituents of water abound in other combinations in the external earth-crust. Whatever the uncertainties, any definite estimate of future population made in the light of limitations arising in current knowledge of resources is more likely to be found too small than too large as knowledge and command over nature advance with the progressive development of mankind.

W J McGEE

THE SILLIMAN LECTURES

THE Silliman lectures for 1911 will, as already announced, be given at Yale University by Professor Max Verworn, of the University of Bonn. They will be given in Lampson Hall at five o'clock on successive days beginning on Monday, October 9. The subjects are as follows:

I. Historical Observations on the Doctrine of Irritability.
II. The Meaning of Stimuli.
III. The Special Characteristics of Stimuli.
IV. The General Effects of Stimulation.
V. The Analysis of Excitation.
VI. The Conductivity of Excitation.
VII. Refractory Period and Fatigue.
VIII. The Interference of Excitation.
IX. The Interference of Excitation. (*Continued.*)
X. The Processes of Depression.

The preceding lectures on the Silliman foundation have been:

1903. Professor Thomson, Cambridge University: Electricity and Matter.
1904. Professor Sherrington, University of Liverpool: Integrative Action of the Nervous System.
1905. Professor Rutherford, McGill University: Radio-active Transformations.
1906. Professor Nernst, University of Berlin: Applications of Thermodynamics to Chemistry.
1907. Professor Bateson, Cambridge University: The Problems of Genetics.
1908. Professor Penck, University of Berlin: The Problems of Glacial Geology.
1909. Professor Campbell, Lick Observatory, University of California: Stellar Motions.
1910. Professor Arrhenius, University of Stockholm: The Theories of Solutions.

SCIENTIFIC NOTES AND NEWS

PROFESSOR W. S. EICHELBERGER, director of the Nautical Almanac, will represent the United States at a conference of the directors of the National Nautical Almanacs to be held at Paris from October 23 to 28.

AT Harvard University Professors W. M. Davis (geology), P. H. Hanus (education), E. V. Huntington (mathematics) and E. B. Holt (psychology) have leave of absence from the university for the academic year 1911–12; Professors Theobald Smith (comparative pathology), George Santayana (philosophy), R. B. Perry (philosophy) and D. W. Johnson (physiography), for the second half-year.

THE Hanbury gold medal of the British Pharmaceutical Society has been awarded to M. Eugene Léger, of the Hôpital St. Louis, Paris.

DR. G. A. HANSEN, president of the permanent international committee on leprosy, was one of the founders of the *Medicinsk Revue* in Norway in 1884. On the occasion of his seventieth birthday recently, as we learn from the *Journal* of the American Medical Association, the *Revue* issued a special *Festschrift* number in his honor with fifteen articles on various topics, especially leprosy and pellagra, all by Norwegian writers.

PROFESSOR CHARLES L. EDWARDS, of the University of Southern California, has been placed in charge of the abalone investigations instituted by the Fish and Game Commission of the state of California.

WE learn from *Nature* that Mr. J. J. Nock has been appointed by the British secretary of